

Diagnostics and Prognostics Using Temporal Causal Models for Cyber Physical Systems ? A Case of Smart Electric Grid

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[Abhishek Dubey](#)[Chen Ching-Liu](#)[Srdjan Lukic](#)[Gabor Karsai](#)[Nagabhushan Mahadevan](#)[Anurag Srivastava](#)

Abstract:

The onset of Internet of Things and the increasing capability of low powered sensors is enabling newer classes of cyber-physical systems that integrate multiple domain. The resiliency and reliability of critical systems like cyber physical energy systems (Smart Grids) are of paramount importance. These critical systems are often equipped with specialized devices for arresting/ suppressing disturbances. However, operation of such local protection elements is known to cause cascading effects. Traditional rule based algorithms are inefficient for diagnosing and detecting faults in such large systems. Our approach is based on Temporal causal diagrams that capture the interactions between timed discrete models of system components and failure propagation graphs constrained with system modes. In this paper we present a refinement of the TCD language with a layer of independent local observers that aid in diagnosis. A systematic way of generating failure propagation graphs from system topology and obtaining observer models from discrete components is also described along with a novel two tier failure diagnosis and prediction approach.

Abhishek Dubey | Chen Ching-Liu | Srdjan Lukic | Gabor Karsai | Nagabhushan Mahadevan | Anurag Srivastava
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